

BLUEPRINT

California Energy Commission
Efficiency Division

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Tubular LED Lamps and the 2016 Energy Standards

The *2016 Building Energy Efficiency Standards* (Energy Standards) allows tubular light emitting diode (TLED) lamps to replace linear fluorescent lamps in existing luminaires. The power of luminaires with TLED lamps is determined according to **Section 130.0(c)6** and depends on whether the luminaire uses a fluorescent ballast or LED driver.

TLED Lamp with Fluorescent Ballast

If a fluorescent ballast powers the TLED lamp, luminaire power is determined according to

the operating input wattage of the lamp and ballast combination per **Section 130.0(c)6A**.

Reference Nonresidential Appendix NA8 (NA8) has tables of lamp and ballast combinations. These tables provide an alternate method for determining luminaire power for any lamp and ballast combination specifically listed in NA8.

To determine luminaire power where fluorescent ballasts are used with TLED lamps, find the matching ballast and type/length of linear or U-shaped fluorescent lamp and use the value given in the table. If more than one value applies, use the smallest appropriate value.

TLED Lamp with LED Driver

If an LED driver powers the TLED lamp, luminaire power is determined according to the maximum input wattage of the driver per **Section 130.0(c)6B**.

Examples:

For a two-lamp luminaire with 4-foot TLED lamps and fluorescent ballast, the lowest wattage in **Table NA8-3** corresponds to two-lamp F32T8/30ES, EE reduced output ballast at 45 watts. Therefore, luminaire power is 45 watts.

For a three-lamp luminaire with 3-foot TLED lamps and fluorescent ballast, the lowest fluorescent wattage in **Table NA8-3** corresponds to three-lamp F25T8, electronic reduced output ballast at 59 watts. Therefore, luminaire power is 59 watts.

For a two-lamp luminaire with 4-foot TLED lamps and LED driver, the manufacturer rated input wattage of the driver is 30 watts. Therefore, luminaire power is 30 watts.

HVAC Videos Now Available!

Educational videos are now available on the Online Resource Center (ORC). These videos support the 2016 Energy Standards for heating, ventilation, and air-conditioning (HVAC) requirements in low-rise residential buildings. To view the videos listed below, please visit the **ORC**.

- » Course 1: Introduction - Mandatory, Prescriptive, and Performance Requirements - Understanding the Differences
- » Course 2: What's New in 2016
- » Course 3: Mandatory Measures for Heating and Cooling Systems
- » Course 4: Automatic Setback Thermostats
- » Course 5: Mandatory Measures for Air Distribution Systems
- » Course 6: Indoor Air Quality and Mechanical Ventilation
- » Course 7: Prescriptive Method of Compliance
- » Course 8: Performance Method of Compliance
- » Course 9: HVAC Alterations and Changeouts

High Performance Attics and Batt Insulation Below the Roof Deck

The 2016 Energy Standards introduced prescriptive high performance attic requirements for low-rise residential buildings in **Section 150.1(c)1A**. The high performance attic requirements are satisfied in one of two ways:

1. By insulating the roof and attic floor of a vented attic.
2. By bringing the HVAC system inside the conditioned space and insulating the attic floor of a vented attic.

In a scenario where insulation is placed at the roof and attic floor, insulation can be installed at the roof level either above or below the roof deck. When installed below the roof deck, insulation can be in the form of blown-in netted insulation, spray polyurethane foam, or batt insulation, among others.

When no air space is provided between the roofing product and the roof deck, like with asphalt shingles, the prescriptive requirement for insulation installed below the roof deck is R-18 in climate zones 4 and 8 through 16. When batt insulation thickness exceeds the depth of the roof framing members, full width batts should be used to prevent sagging. Batt insulation must also be supported with straps when specified by the manufacturer's instructions. Compression at the straps is assumed and is acceptable. Below deck batt or blanket insulation must be installed in a manner that does not obstruct eave, ridge, or eyebrow vents to allow for adequate attic ventilation. The required net free ventilation area

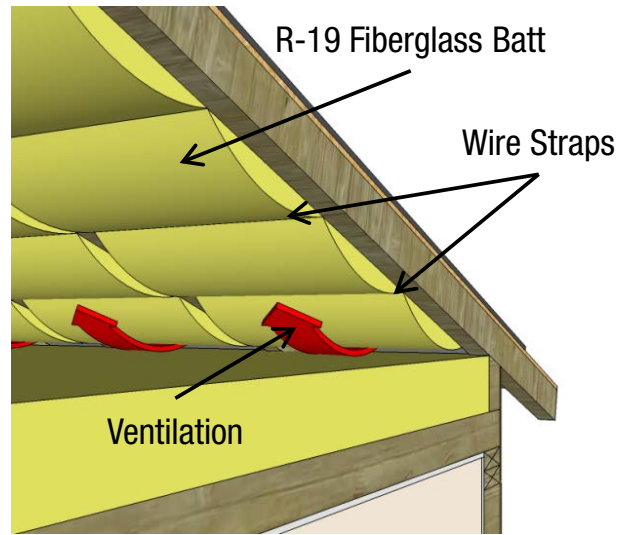


Figure 2 - Angled, three dimensional view of roof assembly with below roof deck insulation secured at regular intervals.

of all eave and roof vents must be maintained. Eave vent baffles should also be installed to prevent air movement under or into the batt. See Figures 1 and 2 for examples of this type of assembly.

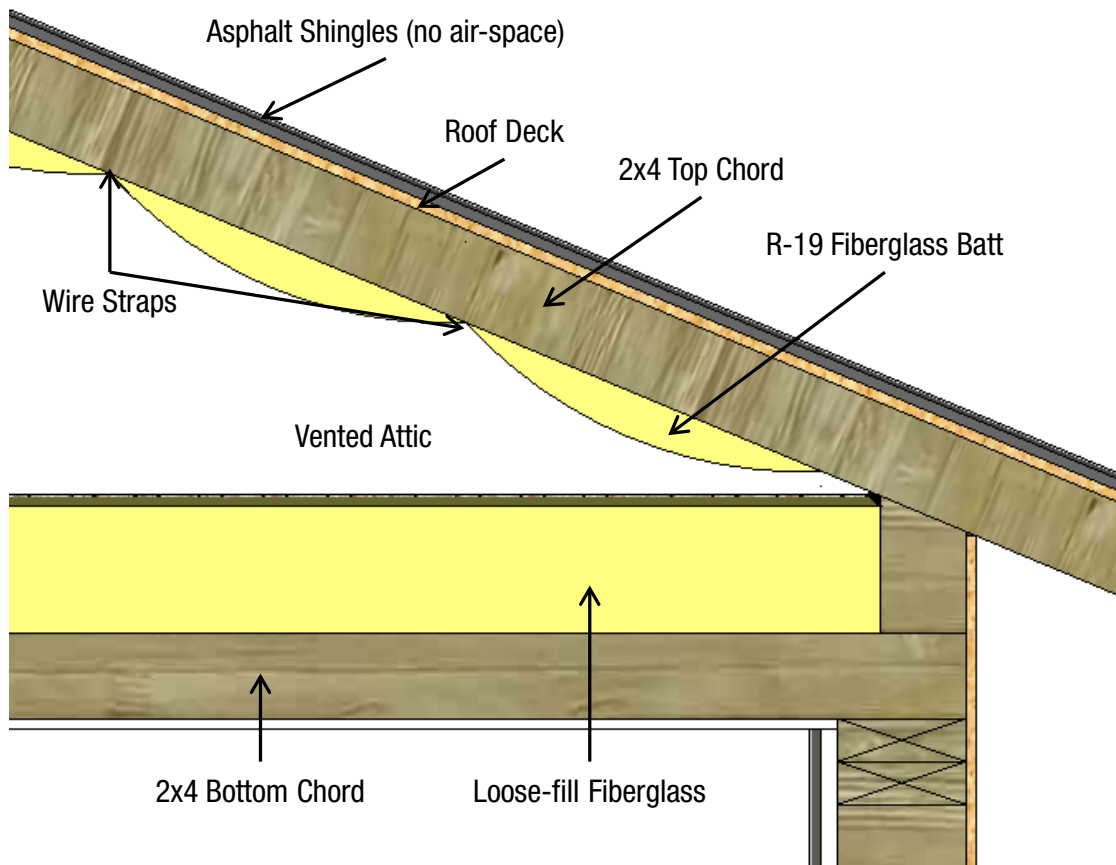


Figure 1 - Side view of roof assembly with below roof deck insulation secured at regular intervals.

Electrical Power Distribution Systems

The applicability of electrical power distribution (EPD) system requirements to additions and alterations has been updated in the 2016 Energy Standards. The separation of electrical circuit and controlled receptacle requirements are now only applicable to entirely new or complete replacements of EPD systems per **Sections 141.0(a), 141.0(b)2P, and 141.0(b)3**. This update was made to facilitate compliance with the EPD system requirements for additions and alterations.

The “entire EPD system” includes the service equipment and all EPD equipment downstream from the service equipment. The 2016 Energy Standards defines **service equipment** as:

“The necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cut-off of the supply.”

Additions to or partial replacements of existing EPD systems no longer trigger the separation of circuit or controlled receptacle requirements under the 2016 Energy Standards.

New Resources Added to the Online Resource Center!

Energy Code Ace resources for the 2016 Energy Standards are available on the **ORC**. Checklists, fact sheets, trigger sheets, and application guides have been added for:

- » Commissioning
- » Electrical Power Distribution
- » Lighting
- » HVAC
- » Solar Ready
- » And more

The ORC is the central location for Energy Standards educational resources.

Q&A

Tubular LED Lamps

Is there a definition for TLEDs and are there requirements that apply specifically to these products?

No. TLED products are not defined nor handled differently from other LED retrofit approaches. LED retrofit options for fluorescent luminaires include products that use the existing lamp holders. They also include products that are installed in existing fluorescent troffers that do not make use of the lamp holders.

How are LED retrofits for fluorescent luminaires rated and classified? Are they rated differently if they are part of an addition, alteration, or repair?

LED retrofits are rated and classified according to **Section 130.0(c)** whether they are a new installation, addition, alteration,

or repair. The classification is based on the permanently installed components of the luminaire, not the lamps. If the retrofit is made up of LED lamps that use existing fluorescent ballasts for power, then the luminaire will be classified under **Section 130.0(c)6A**. If the retrofit is made up of LED lamps paired with a driver, then the luminaire will be classified under **Section 130.0(c)6B**. Luminaires with LED light engines are classified under **Section 130.0(c)9**.

I’m considering a lamp changeout of an existing lighting system. There will be no alterations to the wiring or lighting system other than installing new lamps (I am just replacing tubular fluorescent lamps with tubular LED lamps). Does this trigger 2016 Energy Standard requirements?

No. However, if lamps and ballasts are replaced, or if you bypass the ballast and use a driver, the project may trigger luminaire component modification requirements in **Section 141.0(b)2J**.

I’m considering replacing tubular fluorescent lamps with TLED lamps as part of a larger lighting system alteration. What method can I use to determine the luminaire power for these luminaires?

To comply with **Section 130.0(c)6**, NA8 can be used to determine luminaire power where fluorescent ballasts are used with TLED lamps. Find the matching ballast and type/length of linear or U-shaped fluorescent lamp, and use the value given in the table. If more than one value applies, use the smallest appropriate value.

Electrical Power Distribution Systems

Would an alteration of a branch circuit trigger the separation of circuit requirements of Section 141.0(b)2Pii?

No. Since this alteration is not a complete replacement of the existing EPD system, the separation of electrical circuit requirements do not apply.

Would adding a new panel to an existing electrical power distribution system trigger the separation of circuit requirements of Section 141.0(b)2Pii?

No. Adding one panel does not constitute a complete replacement of an EPD system.

I have a retail tenant improvement. We are stripping the entire space of all panels and electrical wiring, including the service equipment. Does this alteration trigger the separation of circuit requirements of Section 141.0(b)2Pii?

Yes. This is a complete replacement of the EPD system.

Would adding receptacles to an existing office trigger the controlled receptacle requirements of Section 141.0(b)2Piv?

No. Because the entire EPD system is not being replaced, the controlled receptacle requirements are not applicable.

I have a retail tenant improvement. We are stripping the entire space of all panels and electrical wiring, including the service equipment. Does this alteration trigger the controlled receptacle requirements of Section 141.0(b)2Piv?

Yes. This is a complete replacement of the EPD system.

My project includes an addition of office space to an existing building. If I have an existing service to which no modification is being done, are controlled receptacles required for the new office space?

No. Because the entire EPD system is not being replaced, the controlled receptacle requirements are not applicable.

For More Information

Home Energy Rating System:

<http://www.energy.ca.gov/HERS/>

Acceptance Test Technician

Certification Provider Program:

<http://www.energy.ca.gov/title24/attcp/>

Approved Compliance Software:

http://www.energy.ca.gov/title24/2016standards/2016_computer_prog_list.html

The California Energy Commission

welcomes your feedback on Blueprint.

Please contact Andrea Bailey at:

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SPECIAL THANKS

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» Javier Perez	
» Kristen Driskell	

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**CALIFORNIA
ENERGY COMMISSION**

Need Help? Energy Standards Hotline
(800) 772-3300 (toll-free in CA)
Title24@energy.ca.gov

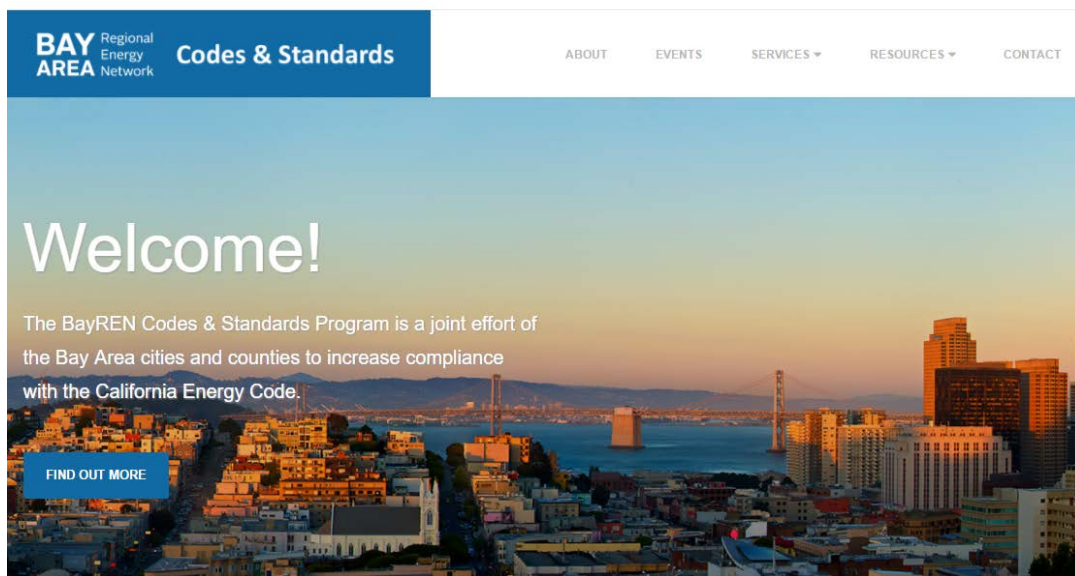
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CEC-400-2017-008

"Bay Area communities working together for a sustainable energy future."

BayREN Codes & Standards

The BayREN Codes & Standards Program is a joint effort of the Bay Area cities and counties to increase compliance with the California Energy Code.



Visit the new BayREN Codes & Standards website!
www.bayrencodes.org



Trainings

BayREN offers ICC certified trainings designed to help local building department staff and building professionals perform Energy Code compliance and enforcement best practices.

- **Title 24, Part 6, On-Demand Trainings:** BayREN now offers three online training courses designed to educate in key aspects of code compliance and enforcement at no cost.
- Participate in one of our on-demand trainings today, <http://www.bayrencodes.org/services/trainings/>

Courses are
ICC approved
for 0.1 CEUs



Regional Forums

Regional Forums bring together state and local government policy makers and implementers, building department staff, architects, energy consultants and other stakeholders to network and learn about Bay Area energy code, energy efficiency, and zero net energy policies and programs. Remote attendance is available for all our forums. Recent forum topics include:

- **Local Mandatory Solar Ordinance as a Pathway for New Residential ZNE Construction**
This forum focused on the CEC's Model Local Solar Ordinance for residential new construction. Expert speakers provided a technical review of the model ordinance, cost-effectiveness study and resources available to local governments in navigating the adoption process.
- **Household Electrification as a Pathway to On-Site ZNE**
This workshop helped local governments address misconceptions and answer questions about 2016 Title 24, Part 6 (Energy Code) implications for designing new, or applying deep energy retrofits for all-electric low-residential buildings.
- To view recordings of past forums and to register for upcoming forums, visit www.bayrencodes.org/events/



Resources

BayREN provides various resources for local sustainability, building and facility departments.

- **Municipal ZNE Resources:** BayREN has created a Municipal Zero Net Energy Resources and Templates Packet that provides policy analysis and template language to help jurisdictions take early action toward the State's ZNE goals.
- **Customized Permit Guides:** BayREN offers eight permit guides that can be customized with jurisdiction-specific branding. Permit guides offer an effective, easy to implement, and no-cost solution to customer questions about energy reviews by busy building departments.
- All resources are available for download, visit www.bayrencodes.org/resources/

For more information:

Email: codes@bayren.org
Website: www.bayrencodes.org

The California
Statewide Codes &
Standards Program

Here to help you meet
the requirements of
Title 24, Part 6 and
Title 20

We offer FREE

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All designed to
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content/training-request/**
to bring a training to a
location of your choice!

6/28/2017

DATE • TIME	LOCATION	INSTRUCTOR	REGISTRATION LINK
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Residential Standards for Plans Examiners and Building Inspectors ★

July 12 • 8:30 - 4:30	Tulare	Bruce Cheney	sce.com/energycenters
July 13 • 8:30 - 4:30	Downey	Bruce Cheney	seminars.socalgas.com
July 13 • 8:30 - 4:30	San Jose	Marina Chaves	goo.gl/t1bvX5
July 12 • 8:30 - 4:00	San Diego	Bruce Cheney	sdge.com/eic/seminar
July 28 • 8:30 - 4:30	Napa	Brian Selby	goo.gl/3hAe9h
August 3 • 8:30 - 4:30	Santa Barbara	Bruce Cheney	sce.com/energycenters
August 17 • 8:30 - 4:30	Jackson	Marina Chaves	pge.com/energyclasses
August 30 • 8:30 - 4:30	Stockton	Marina Chaves	pge.com/energyclasses

Nonresidential Standards for Plans Examiners and Building Inspectors ★

July 19 • 8:30 - 4:00	San Diego	Bruce Cheney	sdge.com/eic/seminar
July 26 • 8:30 - 4:30	Tulare	Bruce Cheney	sce.com/energycenters
July 27 • 8:30 - 4:30	Downey	Bruce Cheney	seminars.socalgas.com
August 11 • 8:30 - 4:30	Napa	Brian Selby	pge.com/energyclasses
August 17 • 8:30 - 4:30	Santa Barbara	Bruce Cheney	sce.com/energycenters
September 27 • 8:30 - 4:30	El Centro	Bruce Cheney	sce.com/energycenters

Residential Standards for Energy Consultants ★

September 7 • 8:30 - 4:00	San Diego	Bruce Cheney	sdge.com/eic/seminar
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Nonresidential Standards for Energy Consultants ★

September 6 • 8:30 - 4:00	San Diego	Bruce Cheney	sdge.com/eic/seminar
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Standards & Technology for Residential Lighting ★

August 3 • 8:30 - 4:00	San Diego	Gina Rodda	sdge.com/eic/seminar
August 22 • 8:30 - 12:00	Irwindale	Nicole Graeber	sce.com/energycenters

Standards & Technology for Retail Lighting ★

August 1 • 8:30 - 4:30	San Jose	Nicole Graeber	goo.gl/Ms2jlb
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Standards & Technology for Office Lighting ★

July 11 • 8:30 - 4:30	San Jose	Nicole Graeber	goo.gl/sDfYLR
August 2 • 8:30 - 4:00	San Diego	Gina Rodda	sdge.com/eic/seminar
August 21 • 8:30 - 4:30	Irwindale	Nicole Graeber	sce.com/energycenters

Nonresidential Standards for Architects ★

September 19 • 8:30 - 4:00	San Diego	Gina Rodda	sdge.com/eic/seminar
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Title 24: Where We're Headed with the 2016 Standards ★

July 18 • 8:30 - 12:30	Irvine	Martyn Dodd	sce.com/energycenters
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Delivered online in real-time by an instructor. Classes are delivered in 3 parts, 1 each day in a series.

DATE • TIME	LOCATION	INSTRUCTOR
Residential Standards for Energy Consultants *		
July 25 - 27 • 9:00 - 12:00	Online	Brian Selby
September 12 - 14 • 9:00 - 12:00		
October 17 - 19 • 9:00 - 12:00		
December 5 - 7 • 9:00 - 12:00		

Nonresidential Standards for Energy Consultants *

July 18 - 20 • 9:00 - 12:00	Online	Brian Selby
August 8 - 10 • 9:00 - 12:00		
October 3 - • 9:00 - 12:00		
October 31 - November 2 • 9:00 - 12:00		
December 12 - 14 • 9:00 - 12:00		

Residential Modeling *

August 8 - 10 • 9:00 - 12:00	Online	Martyn Dodd & Ted Tiffany
August 29 - 31 • 9:00 - 12:00		
October 10 - 12 • 9:00 - 12:00		
November 7 - 9 • 9:00 - 12:00		

Nonresidential Modeling *

July 11 - 13 • 9:00 - 12:00	Online	Martyn Dodd & Ted Tiffany
August 15 - 17 • 9:00 - 12:00		
September 19 - 21 • 9:00 - 12:00		
October 24 - 26 • 9:00 - 12:00		
November 14 - 16 • 9:00 - 12:00		

- Residential Standards for AC Quality Installation Contractors *
- Residential Standards for Indoor Lighting *
- Residential Standards for Ventilation *
- Nonresidential Standards for Indoor Lighting Mandatory Measures *
- Nonresidential Standards for Indoor Lighting Prescriptive Compliance *
- Title 20 Essentials: The Water-Energy Nexus

Take them whenever and wherever you like, at your own pace. Visit EnergyCodeAce.com

Our new Title 20 Appliance Efficiency curriculum focuses on the essentials industry professionals and consumers need to know to use the California Energy Commission's Modernized Appliance Efficiency Database System (MAEDBS). Access our video trainings on the following topics at:

energycodeace.com/content/title-20-ondemand

- Title 20 Essentials: Making the Most of On-Demand Video Training
- Title 20 Essentials: Why Certification Matters
- Title 20 Essentials: Using MAEDBS for Manufacturers
- Title 20 Essentials: Using MAEDBS for Third Party Certifiers
- Title 20 Essentials: Using MAEDBS for Test Laboratories
- Title 20 Essentials: California Appliance Standards for Retailers, Distributors, Contractors, and Importers

Facilitated online discussion forums for building department personnel and other industry professionals.

Go to EnergyCodeAce.com for upcoming topics, dates, times and to view recorded past events.

Software Training

DATE • TIME	LOCATION	INSTRUCTOR	REGISTRATION LINK
Beginning EnergyPro Residential ⚡			
September 14 • 8:30 - 12:00	San Francisco	Martyn Dodd	pge.com/energyclasses
December 13 • 12:30 - 4:00	San Francisco		pge.com/energyclasses
Beginning EnergyPro Nonresidential ⚡			
September 13 • 8:30 - 12:00	San Francisco	Martyn Dodd	pge.com/energyclasses
December 12 • 8:30 - 12:00	San Francisco		pge.com/energyclasses
Advanced EnergyPro Residential ⚡			
July 19 • 1:00 - 4:30	Irwindale	Martyn Dodd	sce.com/energycenters
September 14 • 1:00 - 4:30	San Francisco		pge.com/energyclasses
December 13 • 1:00 - 4:30	San Francisco		pge.com/energyclasses
Advanced EnergyPro Nonresidential ⚡			
July 19 • 8:30 - 12:00	Irwindale	Martyn Dodd	sce.com/energycenters
September 13 • 1:00 - 4:30	San Francisco		pge.com/energyclasses
December 12 • 1:00 - 4:30	San Francisco		pge.com/energyclasses